

THE MINERAL INDUSTRY OF VIETNAM

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Vietnam, which is located north of the Gulf of Thailand, west of the Gulf of Tonkin and the South China Sea, east of Cambodia and Laos, and south of China in Southeast Asia, was a low-income developing country. Its per capita gross domestic product (GDP) based on purchasing power parity was estimated to be \$2,337 (International Monetary Fund, 2004¹). Vietnam's land area is about 325,400 square kilometers (km²). It had a population of about 80.7 million in 2003.

The country has a wide variety of mineral resources. According to the Department of Geology and Minerals of Vietnam, the identified important mineral resources were bauxite, chromite, coal, copper, natural gas, gold, iron ore, nickel, crude petroleum, phosphate rock (apatite), rare earths, tin, titanium, and tungsten. Other identified but less important mineral resources were barite, carbonate rocks (limestone, and marble), gemstones (ruby and sapphire), graphite, lead, manganese, silica sand, zinc, and zirconium (Le Van De, 1996; Lai Hong Thanh, 2002§; Truong Duc Chinh, 2002§). In 2003, Vietnam was the third leading producer of anthracite coal in the world, the sixth largest producer of crude petroleum in the Asia and the Pacific region, and one of the major producers of ilmenite and phosphate rock in Asia ((Oil & Gas Journal, 2003b; U.S. Energy Information Administration, 2004§).

The exploration conducted by the state-owned mining companies and foreign companies during the past 5 years had identified substantial bauxite reserves in the Central Highlands and had discovered a significant polymetallic deposit that contains substantial reserves of tungsten and associated minerals, such as bismuth, copper, fluorite, and gold at Nui Phao, which is located about 80 kilometers (km) north of Hanoi in the Province of Thai Nguyen.

With the exception of carbonate rocks, coal, and hydrocarbons, most mineral resources remained largely unexploited owing to Vietnam's outdated mining equipment and technology, poor infrastructure, and uncompetitive Government policy to attract foreign investors in mining.

Exploitation of the country's ferrous and nonferrous metals resources was still in the early stage of development. Mining and processing were by the state-owned and non-state-owned joint-stock, limited-liability, and private companies, combines, cooperatives, and individuals, mostly through small- and medium-scale operations.

The mining and quarrying sector, which was dominated by the coal, construction materials, and oil and gas industries, comprised 456 state-owned companies and the following non-state-owned entities: 120 joint-stock, limited-liability, and private companies; 114 combines and cooperatives; 118 individuals; and 18 foreign-owned companies (Lai Hong Thanh, 2002§). The total number of employees in the mining and quarrying sector was about 227,500 (General Statistics Office, 2003, p. 41).

In 2002 (the last year for which data were available), the output of the mining and quarrying sector contributed 6.2% to Vietnam's GDP. The output value of the mining and quarrying sector at 1994 constant prices was estimated to be \$1.27 billion in 2002. Vietnam's GDP at 1994 constant prices was estimated to be \$20.54 billion in 2002 (General Statistics Office, 2003, p. 57-58).

In 2003, Vietnam's real GDP grew by 7.1% compared with 6.4% in 2002. The higher economic growth in 2003 was the result of a 9.4% increase in domestic demand and a 15.8% increase in investment. On the supply side, the industry sector, which contributed 38.7% to Vietnam's GDP in 2003, grew by 9.6%. The country's inflation rate was 4.5% compared with 4.0% in 2002 (Asian Development Bank, 2004§; Vietnam Panorama, 2004a§).

In 2003, the country had a merchandise trade deficit of about \$5 billion, with exports and imports estimated to be about \$20 billion and \$25 billion, respectively. In minerals trade, Vietnam was a net importer because of its large imports of refined petroleum products (\$2.41 billion), steel products (\$1.64 billion), and manufactured fertilizers (\$604 million). Vietnam's major exports of mineral commodities were crude petroleum (\$3.78 billion) and coal (\$180 million) in 2003 (Vietnam Panorama, 2004b§).

Commodity Review

Metals

Aluminum, Bauxite, and Alumina.—To develop the bauxite resources of the Tan Rai District in the Province of Lam Dong, Aluminium Pechiney of France completed a feasibility study for an integrated, bauxite-alumina-aluminum facility in the third quarter of 2002. In December 2002, the feasibility study was submitted by state-owned Vietnam National Minerals Corp. (VIMICO) to the Ministry of Industry and the Prime Minister's office for approval. In June 2003, VIMICO announced that it would construct the \$680-million bauxite-alumina-aluminum facility in the Bao Lam District in the Province of Lam Dong and that technical assistance would be provided by Pechiney. The facility, which was scheduled to be commissioned in 2006 or early 2007, will have the capacity to produce 2 million metric tons per year (Mt/yr) of bauxite and 300,000 metric tons per year (t/yr) of alumina, of which 140,000 t/yr will be smelted onsite to produce 72,600 t/yr of aluminum ingot for the domestic market. The electricity would be supplied from the nearby Ham Thuan Da Mi powerplant at the rate of one billion kilowatt hours per year (Pechiney, 2002; Vietnam News, The, 2002§; Interex.be, 2003§).

To develop the bauxite resources of the Dak Nong District in the Province of Dak Lak, the China Nonferrous Mining and Construction Group planned to update a prefeasibility study that it had conducted in 2001 on an estimated \$1.5 billion bauxite-

¹ References that include a section mark (§) are found in the Internet References Cited section.

aluminum processing complex at Dak Nong in the Province of Dak Lak. An agreement was reached between Vietnamese and Chinese officials in May 2002 to form a joint venture to develop the project. In December 2003, Aluminum Corp. of China reportedly agreed to join China Nonferrous Mining and Construction Group to update the prefeasibility study and to develop the bauxite mine in the Province of Dak Lak at an estimated cost of \$1.35 billion (Mining-Journal.com, 2003; Vietnam Style.com, 2003a§).

Copper.—According to Vietnam News Agency, VIMICO began ground work on the site of a \$65 million copper mine and smelter complex at Sin Queyen in the Province of Lao Cai in September 2003. The construction work was scheduled for completion in late 2004 and a test run was to be held in the first quarter of 2005. Operations would begin in the second quarter of 2005. The mining and milling complex would have a capacity to mine and process up to 1.2 Mt/yr of ore to produce 42,000 t/yr of copper concentrate with an average metal content of 25% copper; 110,000 t/yr of iron ore; and about 20,000 t/yr of sulfur. The smelter would have a capacity to produce 10,500 t/yr of refined copper and byproducts, which could include 340 kilograms per year (kg/yr) of gold, 145 kg/yr of silver, and 40,000 t/yr of sulfuric acid. Copper ore resources in the area were estimated to be 50 million metric tons (Mt). According to VIMICO, the project would be financed by more than \$40 million in soft loans from the Export-Import Bank of China. VIMICO would provide the remaining \$12 million (Vietnam Style.com, 2003b§).

Gold.—Vietnam produced about 2 t/yr of gold. To meet the domestic demand for gold in 2003, the country reportedly imported about 50 t of gold, of which about 80% was imported through unofficial channels. To reduce the price of gold bar and enable the manufacturers of gold jewelry to reduce their production costs and be more competitive in the regional market, the Ministry of Finance reduced the tariff on gold bar imports to 1% from 3% and on gold grains to 0.5% from 1%, effective April 2004. According to the World Gold Council, the demand for gold in Vietnam had been growing at a rate of about 5% per year during the past several years and was about 59 t in 2003; jewelry manufacturers and private investors were the two major gold end users (World Gold Council, 2004§).

In a bid to liberalize Vietnam's small bullion market, the Vietnam Central Bank issued unlimited quotas for gold imports in May 2003. According to the State Bank of Vietnam, 14 gold traders and commercial banks had been permitted to import about 8 t of gold to stabilize the domestic market (Vietnamtrade.org, 2003b§; Yahoo.com, 2003b§).

In 2003, Olympus Pacific Minerals Inc. of Canada continued its gold exploration project at Phuoc Son in the Province of Quang Nam and moved closer to building a pilot plant in 2004. According to Olympus Pacific Minerals, its 2003 exploration program at the Phuoc Son gold project comprised 2,400 meters of diamond drilling and in-fill drilling at the Bai Dat and Bai Go mineralized zones. In July, the company submitted an initial mining license application to the Government for a 0.5-km² area that covered the Bai Dat and Bai Go zones within the Dak Sa shear zone (Olympus Pacific Minerals Inc., 2003a§, b§).

During 2003, Olympus Pacific Minerals conducted a feasibility study for the Bai Dat and Bai Go deposits, where the presence of very high bonanza-grade gold mineralization had been confirmed by the 2003 drilling program, to develop an underground mine and a pilot plant with a capacity to process about 300 metric tons per day of ore (Minesite.com, 2003a§, b§). According to Olympus Pacific Minerals, the total measured and indicated gold resources of the Bai Dat and Bai Go deposits were estimated to be 318,000 t at a grade of 14.32 grams per metric ton (g/t) gold that contained 147,000 ounces [4,570 kilograms (kg)] of gold. Inferred gold resources of the Bai Dat and Bai Go deposits were estimated to be 188,000 t at a grade of 12.12 g/t gold that contained 74,000 ounces (2,300 kg) of gold (Olympus Pacific Minerals Inc., 2004§).

Iron and Steel.—Crude steel production rose to 544,000 t in 2003 from 319,000 t in 2001 because of increased tariffs on imports of billet in 2003. Crude steel was produced mainly by Thai Nguyen Iron and Steel Co. (TNISC), which had an annual capacity of 240,000 t, and Southern Steel Co. (SSC), which had an annual capacity of 200,000 t. TNISC and SSC were wholly owned subsidiaries of the state-owned Vietnam Steel Corp. (VSC). Vietnam's steel industry continued to have an imbalance between upstream (crude steel production) and downstream (rolled steel production) in 2003. Vietnam imported about 4.5 Mt of iron and steel products, of which 1.8 Mt was crude steel in the form of billets, to meet the domestic demand for crude steel by its growing number of rolling mills (Vietnam Panorama, 2004b§).

To reduce the country's reliance on imports of crude steel, VSC planned to build two new billet plants by 2005. In the south, SSC was to build a 500,000-t/yr steel billet plant in the Phu My industrial zone near Ho Chi Minh City in the Province of Ba Ria-Vung Tau. In March 2003, VSC awarded Danieli & Compagnia Officine Merccaniche SpA of Italy the \$88 million contract to build the Phu My steel billet plant. According to VSC, the entire Phu My project, which included the billet plant and a new bar and rod mill, was expected to cost between \$134 million and \$150 million, of which SSC would invest \$12 million and the rest would be sourced from the Finance Ministry's Development Assistance Fund and domestic banks. VSC began preparation work on the project and construction of the southern plant in 2003; the project was scheduled for completion in late 2004 and would be ready for commissioning by early 2005. In the north, VSC planned to construct a 500,000 t/yr billet plant with an unspecified startup date at the Quang Ninh Steel Ingots Processing and Rolling plant in Cai Lan on the coastal province of Quang Ninh (Southeast Asia Iron and Steel Institute, 2003c§; Yahoo.com, 2003a§).

In April, the Ministry of Industry appointed the consultancy arm of Arcelor S.A. to conduct the feasibility study for the building of a 4.5 Mt/yr integrated steelmaking complex in the Thach Ke District in the Province of Ha Tinh. A prefeasibility study for the Ha Tinh steelmaking complex had been completed by the Japan International Cooperation Agency, in cooperation with a Japanese consortium led by Nippon Steel Corp., in 1996. The feasibility study would consider the construction of a \$4 to \$5 billion steel complex that would consist of one blast furnace, two electric arc furnaces, and one continuous slab caster and hot-rolling mill during the first phase. Subsequent phases would involve an additional blast furnace, billet caster, and bar mill. After completion of the entire project, the complex would have a total capacity to produce 1 Mt/yr of long products and 3.5 Mt/yr of flat products. The proposed Ha Tinh steel project would be totally separate from VSC's construction plan for the billet plants in the Provinces of Ba Ria-Vung Tau and Quang

Ninh. According to the Ministry of Industry's forecast, domestic demand for steel could reach as much as 14 Mt/yr by 2020 (Southeast Asia Iron and Steel Institute, 2003a§; 2003d§).

According to the Ministry of Trade and Custom Office, Vietnam's imports of iron and steel totaled 4.5 Mt in 2003, of which 1.8 Mt was steel billet. Imports of iron and steel were valued at \$1.6 billion in 2003, of which \$485 million was for steel billet (Vietnam Panorama, 2004b§).

In May 2001, Vietnam began to lower its import tariffs on iron and steel products and was to make further reductions by 2005 before participating in the Association of South East Asian Nations (ASEAN) free trade area agreement in 2006. To protect and support VSC's future billet plants to be built in the Provinces of Ba Ria-Vung Tau and Quang Ninh, the Government raised its tariff to 5% from 1% on imported billet from its ASEAN neighbors effective July 1, 2003. The tariff on imported billet from non-ASEAN countries was 10%, effective January 1, 2004 (Southeast Asian Iron and Steel Institute, 2003b§).

Lead and Zinc.—Lead and zinc were produced by VIMICO from the Bac Thai, Ha Giang, and Yen Bai deposits. Annual production of zinc concentrate was about 40,000 t at a grade of about 30% zinc and 2.5% lead. The zinc concentrate was exported mainly to China and Thailand.

In September 2003, VIMICO began construction of Vietnam's first zinc smelter in the Province of Thai Nguyen, which was scheduled for completion by the third quarter of 2004. The smelter would have a designed capacity of 10,000 t/yr of zinc slab. A Chinese engineering company had been selected by VIMICO as the main supplier of the \$13 million zinc smelter. The zinc concentrate for the smelter would be supplied from zinc deposits in the Provinces of Bac Can (Khan) and Thai Nguyen (Metal Bulletin, 2003; Mining Journal, 2003b).

Nickel.—Asian Mineral Resources Ltd. of New Zealand, through its wholly owned subsidiary AMR Nickel Ltd., continued to explore for copper and nickel in its 70% owned Ban Phuc Nickel property in the 150-km² Ta Khoa concession, which is located about 180 km west of Hanoi in the Province of Son La. Phase 1 of the feasibility study was commenced and exploration for nickel and platinum-group metals continued in the concession area in 2003. The total resources, which included indicated resources of 6.44 Mt and inferred resources of 1.13 Mt, were estimated to be 7.57 Mt at a grade of 1.43% nickel, 0.29% copper, and 0.02% cobalt. The total resources of the Ban Phuc nickel sulfate deposit were estimated to contain about 108,000 t of nickel (Asian Mineral Resources Ltd., 2004§).

Tungsten.—In 2003, Tiberon Minerals Ltd (TM) of Canada continued to explore for tungsten, fluorite, and associated bismuth, copper, and gold at its 70%-owned Nui Phao polymetallic property, which is located about 80 km north of Hanoi in Thai Nguyen Province. TM commissioned a prefeasibility study in April 2002, which was conducted and completed by AMEC E&C Services Ltd. in conjunction with Knight Piesold Consulting and Laurion Consulting Inc. of Canada. The company announced the results of its positive prefeasibility study in January 2003.

According to TM, the prefeasibility study proposed a \$140 million project, which would carry a 21% internal rate of return, for an open-pit operation with an annual throughput of 3.5 Mt of ore over a 16-year mine life; mineable resources for the mining operation were estimated to be 55.2 Mt at a grade of 0.213% tungsten trioxide, 0.213% copper, 0.102% bismuth, 0.223 g/t gold, and 8.0% fluorite. The processing facilities would produce 6,000 t/yr of tungsten trioxide with an 80% recovery rate, 196,000 t/yr of fluorite with a 70% recovery rate, 5,600 t/yr of copper with a 75% recovery rate, 155.5 kg/yr of gold with a 20% recovery rate, and 360 t/yr of bismuth with a 10% recovery rate (Mining Journal, 2003a; Tiberon Minerals Ltd., 2003b§).

In October 2003, TM announced that it had increased the mineral resources estimate for its Nui Phao tungsten-fluorite deposit and awarded the first two key contracts of the Nui Phao bankable feasibility study. According to TM, the 45 in-fill and step-out drill holes and 9 metallurgical drill holes conducted in 2003 had resulted in a 23% increase over the previous mineral resources estimate. The 2003 updated resources estimate represented a significant increase in the overall metal content of the Nui Phao deposit. This updated mineral resources estimate, which was compiled by AMEC E&C Services and based upon a 0.20% tungsten trioxide equivalent cut-off grade, totaled about 88 Mt compared with the previous estimate of 55.2 Mt. Of the estimated 88 Mt of resources, 25.1 Mt was measured at a grade of .25% tungsten trioxide, 8.4% fluorite, 0.23% copper, 0.108% bismuth, and 0.26g/t gold; 35.5 Mt was indicated at a grade of 0.17% tungsten trioxide, 8.3% fluorite, 0.15% copper, 0.081% bismuth, and 0.16 g/t gold; and 27.4 Mt was inferred at a grade of 0.16% tungsten trioxide, 7.1% fluorite, 0.17% copper 0.078% bismuth, and 0.15 g/t gold. In 2003, TM awarded the final environmental-social impact assessment contract to Knight Piesold of Canada and the final metallurgical test contract to SGS Lakefield Research of Canada. TM indicated that no additional drilling on the deposit would be conducted for the purpose of the bankable feasibility study in 2004 (Tiberon Minerals Ltd., 2003a§).

Industrial Minerals

Barite.—The state-owned Vietnam National Chemical Corp., through its subsidiaries, Investment Consultation for Construction and Mining Technological Development Co. in Hanoi, Thanh Hoa Sepentin Chemicals Co. in the Province of Thanh Hoa, Vietnam Appatite Co. in the Province of Lao Cai, and Vinh Chemical Co. in the Province of Nghe An, produced barite powder for domestic consumption and export. Barite powder was exported by the Tuyen Quang Branch of General Export Import Co., which was one of the leading manufacturers and suppliers of barite powder in Vietnam.

According to a local press report in 2002, Phuc Tinh Co. reportedly was to build a plant with a capacity to produce 40,000 t/yr of barite powder for the oil and gas industry in Nam Cam Industrial Park in the Province of Nghe An (Saigon Times Daily, 2002§).

Cement.—Because of the continued strong demand for cement by the construction industry, Vietnam's cement production increased by 19.5% to 23.3 Mt compared with 19.5 Mt in 2002. In 2003, Vietnam's cement was produced mainly by Vietnam National Cement Corp. (11.4 Mt) through its 10 subsidiaries—Bim Son, But Son, Da Nang, Ha Tien I, Ha Tien II, Hai Phong, Hai Van, Hoang Mai, Hoang Thach, and Tam Diep; by numerous state- and local-government-owned cement-grinding companies (6 Mt) in various provinces; and by 3 joint-venture companies (5.9 Mt)—Chinfong Hai Phong Cement Corp., which was located in Min Due near Hai Phong City; Morning Star Cement Ltd., which was located in Hon Chong in the Province of Kien Giang; and Nghi Son Cement Corp. which was located in Nghi Son in the Province of Thanh Hoa (Vietnamtrade.org, 2003a§; Cementtrade.com, 2004§; Vietnam Panorama, 2004a§).

To meet the strong demand for cement, Vietnam imported 3.55 Mt of clinker during 2003 and was expected to import 4.5 Mt of clinker during 2004. According to the Vietnam Building Materials Association, the cement industry planned to meet demand by producing 29 Mt of cement in 2005, upgrading its outdated equipment and technology, and expanding and building new plants. Industry officials warned that a severe cement shortage could develop as early as 2004 unless the industry invested more in production facilities. The Ministry of Construction projected that demand for cement could reach 25.7 Mt in 2004 and expected a shortfall of cement owing to higher demand by the construction industry (International Cement Review, 2003a; Vietnam Economy.com, 2004§).

In 2003, the Government approved several new cement projects. Donafrance Cement Joint Venture Co. (a joint venture of Dong Nai Roofsheets and Construction Materials Joint Stock Co. of Vietnam and Vture Pte Ltd. of France) planned to build a cement plant with initial investment capital of \$23 million in Nhon Trach District in the Province of Dong Nai. Vietnam Construction Import-Export Corp. planned to build a 2.3-Mt/yr cement plant in Cam Pha in the northern province of Quang Ninh and a crushing plant in Tan Thanh District in the southern Province of Ba Ria-Vung Tau for a total estimated cost of \$312 million (Accessvietnam, 2003§; Mekong Sources, 2003a§).

Other projects initiated in 2003 included the \$53 million project by Holcim (Vietnam) Ltd. (a joint venture of the Holcim Group of Switzerland and Vietnam Cement's Ha Tien Cement 1 Co.) and the \$210 million project by Nghi Son Cement Corp. The Holcim project involved the construction of a 1.3 Mt/yr Thi Vai cement-grinding plant in the Phu My Industrial Zone 1, which is located in Tan Thanh District in the Province of Ba Ria-Vung Tau. The cement-grinding plant, which would be expanded to 3.6 Mt/yr in the future, was scheduled for completion in 2004. The Nghi Son project involved the capacity expansion of the company's Nghi Son plant to 4.3 Mt/yr by 2005; the plant is located in the Province of Thanh Hoa (Cementtrade.com, 2003§; Nhan Dan, 2003§).

Chinfong Hai Phong Cement, which had planned to expand its capacity to 2.6 Mt/yr by 2005, asked the Ministry of Planning and Investment to resolve its dispute with the Vietnam Cement Corp. concerning that company's increase of its equity holdings in their joint venture. The dispute involved a \$170 million expansion plan proposed by Chinfong of Taiwan. Vietnam Cement was insistent that it would not approve the expansion plan unless Chinfong agreed to sell part of its 70% stake in the joint venture to Vietnam Cement Corp. (Vietpartners.com, 2003§).

Mineral Fuels

Coal.—Coal was the second most important mineral commodity, after crude petroleum, produced in Vietnam. In the domestic market, coal was consumed as the main fuel for thermal powerplants; as the primary fuel for the manufacturers of cement, chemicals, metals, paper, and processed foods; and as cooking fuel for urban and rural households. In the export market, coal was one of the major export commodities to earn foreign currency. Because of its high heat-value and low content of ash, nitrogen, phosphorus, and sulfur, Vietnamese anthracite retained a large-percentage share of the anthracite market in Japan and Western European countries, where strict environmental regulations were being implemented (Le Tri Hung, 2002§).

Between 1999 and 2003, Vietnam's coal-mining capacity doubled, coal production rose by 97% to 19 Mt, and coal exports increased by more than 100% to 7 Mt in 2003. Vietnam National Coal Corp. (Vinacoal) controlled most of the mining, distribution, and export of coal. Most of the coal produced in Vietnam was anthracite mainly from the Province of Quang Ninh in northeastern Vietnam.

According to Vinacoal, two major coal mines—the Cua Ong and the Hon Gai, which used new technology imported from Australia and had a combined capacity of 5 Mt/yr—were capable of processing coal at the mine site to meet customers' specifications. Other major coal mines were in the Cam Pha, Cao Son, Coc Sau, Deo Nai, Dong Trieu, Ha Tu, Mao Khe, Mong Duong, and Uong Bi areas. Production of brown coal was mainly from the Na Duong Mine, which is located in the Province of Lang Son.

In previous years, the Vietnamese coal industry had invested more than \$116 million on new imported equipment and technology to expand its coal-production capacity. The new investment included exploration devices, heavy-duty excavators, transport trucks, conveyor belts, hydraulic equipment for deep underground mines, and equipment to improve the safety and productivity of miners in the Districts of Mao Khe, Mong Duong, Uong Bi, Hon Gai, Ha Lam, and Ha Long in the Province of Quang Ninh (Vietnam News, The, 2004a§).

The Vinacoal's expansion projects have been undertaken at the Khe Tam, Nui Beo, Mao Khe, Cao Son, Vang Danh, Yen Tu, Khe Cham, and South Ha Tu Mines, all in the northeastern part of the country. In February 2003, Vinacoal announced that it planned to open six new coal mines in the Province of Quang Ninh during the next 7 years. The mines would be located at Khe Cham, Coc Sau, and Nga Hai. Four of the six mines would be at Khe Cham and were expected to cost \$162.3 million to develop. The Khe Cham No. 1 Mine was expected to produce 600,000 t/yr by 2004; the Khe Cham No. 2 Mine was expected to open in 2007 and to reach full capacity of 1.2 Mt/yr by 2009; the Khe Cham No. 3 Mine was designed to produce 1.5 Mt/yr by 2010; and the Khe Cham No. 4 Mine,

which opened in late 2003, had a capacity of 1.5 Mt/yr. The Coc Sau Mine was expected to begin producing 500,000 t/yr by 2005 and the Nga Hai Mine was expected to produce 1.2 to 1.6 Mt/yr beginning in 2006. According to Vinacoal, the six new mines would boost Vietnam's coal production by more than 30% in the Cam Pha area within the next 3 years and would reach 11.5 Mt in 2005 and 18 Mt in 2010 (Mekong Sources, 2003b§).

According to the Vietnam Government Decision No. 20/2003 on orientation for the coal industry in the 2003-10 planning period, the Government set a target to produce between 23 and 24 Mt of coal in 2010 and between 29 and 30 Mt in 2020. To increase the country's coal output, the coal industry would need \$925 million of capital investment in infrastructure projects between 2003 and 2010 (Japan Coal Center, 2003§).

In 2003, Vietnam's exports of anthracite totaled 7 Mt and were valued at \$181 million. Vietnam's exports of anthracite went mainly to China, the European Union member countries, Japan, Thailand, and other ASEAN member countries (Vietnam Panorama, 2004b§).

Natural Gas and Petroleum.—Natural gas was produced by VietSovPetro (a joint venture of Vietnam Oil and Gas Corp. and Zarubezhneft of Russia) from the small onshore Tien Hai C Gasfield in the Hanoi Trough (part of the Song Hong Basin); associated gas was produced from the larger offshore Bach Ho (White Tiger) and Rang Dong Oilfields, which are located in the Cuu Long Basin. In 2003, natural gas production increased by 52.7% to 3.45 billion cubic meters, and averaged about 9.45 million cubic meters per day (Vietnam News, The, 2004b§). In the domestic market, about 2.4 billion cubic meters of natural gas was consumed as fuel for power generation at the Ba Ria and Phu My electric powerplants and the remainder was consumed as raw materials by the liquefied petroleum gas (LPG) and condensate processing plants at Dinh Co for the production of LPG and gasoline in Vung Tau in the Province of Ba Ria-Vung Tau.

In December 2003, the Japan Vietnam Petroleum Company completed installation of a new platform in the Rang Dong Oilfield. The associated gas from the field was to be transported onshore at the rate of 1.7 million cubic meters per day for use by powerplants in southern Vietnam. The \$140 million platform comprised three subprocessing platforms, a jacket system, and two bridges. The Rang Dong Oilfield was owned by Japan Vietnam Petroleum (52.5%), ConocoPhillips (30%), and PetroVietnam (17.5%) (Vietnam News, the, 2003§).

BP and its partners, ConocoPhillips, ONGC Videsh, and Petro Vietnam, brought the first phase of the \$1.3 billion Nam Con Son project onstream and delivered first gas in November 2002. The project included development of an offshore gasfield; construction of a 399-km pipeline to carry the gas ashore; development of onshore gas-processing facilities; and construction of the 716-megawatt Phu My 3 powerplant, which was expected to come onstream in late 2003. During the first phase of the project, up to 3 billion cubic meters per year of gas would flow ashore to provide power to feed Vietnam's growing industrial base. The gas project tapped reserves discovered in the Lan Tay and Lan Do gasfields in block 06-1. The two fields were estimated to contain 58 billion cubic meters of gas reserves and were expected to supply gas for the next 20 years (BP.com, 2002§).

Crude petroleum was produced by PetroVietnam in joint venture with foreign partners from Canada, France, Japan, Malaysia, Russia, Sweden, and the United States. According to the General Statistical Office, Vietnam produced about 17.69 Mt or an average of 343,200 barrels per day (bbl/d) of crude petroleum in 2003. Vietnam exported 17.17 Mt of crude petroleum and earned \$3.78 billion of foreign currency in 2003 (Vietnam Panorama, 2004a§, b§).

According to PetroVietnam, crude petroleum was produced from six offshore oilfields in three basins—the Bach Ho, which averaged 245,300 bbl/d; the Rong, which averaged 12,000 bbl/d; the Rang Dong, which averaged 43,000 bbl/d; and the Ruby, which averaged 21,000 bbl/d, are located in the Cuu Long Basin; the Bunga Kekwa, which averaged 14,000 bbl/d, is located in the Malay-Tho Chu Basin, which is located off the southern coast of Vietnam between Vietnam and Malaysia; and the Dai Hung, which averaged 2,700 bbl/d, is located in the Nam Con Son Basin. The output from the Bunga Kekwa was shared equally by Vietnam and Malaysia. The output from the Rang Dong Oilfield could be raised to 70,000 bbl/d from 43,000 bbl/d after two new derricks (S1 and E1) are installed and operational (PetroVietnam, 2003§).

ConocoPhillips (23.25%) and its partners, Petro Vietnam (50%), Korean National Oil Corp. (14.25%), SK Corp. (9%), and Geopetrol (3.5%), in Cuu Long Joint Operation Co. (CLJOC) brought the SuTu Den (Black Lion) Oilfields onstream; these oilfields had estimated reserves of 500 million barrels in block 15-1 offshore Vietnam's southeast coast in October 2003. The initial production rate was about 60,000 bbl/d from seven wells in the Phase I area. ConocoPhillips and its partners in CLJOC reportedly discovered oil and gas in the 15-1-ST-1X exploratory well in the SuTu Trang (White Lion) field. Three zones tested at a combined rate of 8,682 bbl/d of oil and about 2 million cubic meters per day of natural gas (Oil & Gas Journal, 2003a; Soconord Group, 2003§). In late December, Talisman Vietnam (30%) and its partners Petro Vietnam (40%) and Petronas Carigalis Overseas Sdn Bhd. (30%) reportedly also made an oil discovery in block 46/02 offshore Vietnam in the Song Doc prospect; a test drill was flowing at the rate of 7,300 bbl/d.

Outlook

For the next 4 to 5 years, Vietnam's mining sector will continue to be dominated by the oil and gas industry. Development of new capacity in copper, gold, and zinc production was expected to be completed in the next 2 to 3 years, but development of new capacity in other nonferrous metals, which includes aluminum, may take longer. The cement and coal industries are expected to expand their capacity to meet the fast-growing demand for cement by the construction industry and for coal by new thermal powerplants during the next 7 to 10 years.

Vietnam's economy is expected to continue to grow at the same pace as that of 2003 during the next 2 years. According to a forecast by the International Monetary Fund (2004§), the Vietnamese GDP was estimated to grow at 7% in 2004 and 2005.

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TABLE 1
VIETNAM: PRODUCTION OF MINERAL COMMODITIES ¹

(Metric tons unless otherwise specified)

Commodity ²	1999	2000	2001	2002	2003 ^p
Barite ^c	25,000	52,500	71,100	60,300	81,500
Cement, hydraulic thousand tons	10,489	13,298	16,073 ^r	19,481 ^r	23,282
Chromium ore, gross weight	58,500	76,300	70,300 ^r	71,000 ^r	75,000 ^c
Clays, kaolin ^c	200,000	520,000	600,000	600,000	650,000
Coal, anthracite thousand tons	9,629	11,609	13,397 ^r	16,347 ^r	18,963
Copper concentrate, gross weight ^c	15,000	15,000	2,000	5,000	10,000
Fluorspar ^c	3,000	3,000	3,000	3,000	3,000
Gas, natural, gross million cubic meters	1,435	1,598	1,724	2,260	3,450
Gold ^c kilograms	1,500	3,000	3,000	2,000 ^r	2,000
Ilmenite, gross weight ^c	91,000	174,000	180,000	180,000	200,000
Lead, mine output, Pb content ^c	1,000	1,200	900	1,100 ^r	1,100
Lime thousand tons	1,026	1,156	1,351 ^r	1,426 ^r	1,450 ^c
Manganese concentrate, gross weight ^c	65,000	65,000	67,000	68,000	68,000
Nitrogen, N content of ammonia	33,000	41,900	52,600	58,400	79,700
Petroleum, crude thousand 42-gallon barrels	107,767	115,373	119,212 ^r	117,753 ^r	125,281
Phosphate rock:					
Gross weight thousand tons	681	785	677 ^r	680 ^r	700 ^c
P ₂ O ₅ content do.	204	236	204 ^r	204 ^r	210 ^c
Pyrite, gross weight ^c do.	150	200	300 ^r	400 ^r	450
Pyrophyllite ^c	20,000	30,000	30,000	30,000	30,000
Sand and gravel thousand tons	77,800	83,200	92,200 ^r	95,000 ^r	98,000 ^c
Salt do.	653	590	669 ^r	755 ^r	800 ^c
Silica sand ^c do.	60,000	60,000	62,000	62,000	63,000
Steel:					
Crude do.	308	306	319	409 ^r	544
Rolled do.	1,357	1,583	1,914 ^r	2,429 ^r	2,682
Stone, building stone thousand tons	49,800	57,600	80,400 ^r	83,700 ^r	85,000 ^c
Sulfur ^c	22,000	22,000	22,000	22,000	22,000
Tin:					
Mine output, Sn content ^c	4,000	4,100	4,500	4,500 ^r	4,600
Metal, smelter	1,693	1,800 ^r	1,131 ^r	1,200 ^r	1,300 ^c
Zinc, mine output, Zn content ^c	12,300 ^r	12,500 ^r	7,500 ^r	12,000 ^r	12,000
Zirconium, gross weight ^c	2,500	5,000	5,400	5,500	5,500

^cEstimated; estimated data are rounded to no more than three significant digits. ^pPreliminary. ^rRevised.

¹Table includes data available through August 6, 2004.

²In addition to the commodities listed, bauxite, benonite, refractory clay, construction aggregates, gemstones, granite, graphite, iron ore, marble, and rare earths were mined, but not reported. Available information is inadequate to make reliable estimates of output levels.

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TABLE 2
VIETNAM: STRUCTURE OF THE MINERAL INDUSTRY IN 2003

(Thousand metric tons unless otherwise specified)

Commodity		Major operation companies and major equity owners	Location of main facilities	Annual capacity
Cement		Chinfong Hai Phong Cement Corp. (Chingfong Group of Taiwan, 70%; Hai Phong Municipal Government, 15.56%; Vietnam National Cement Corp., 14.44%)	Min Duc near Hai Phong City	1,400
Do.		Morning Star Cement Ltd. (Holcim Group of Switzerland, 65%; Vietnam National Cement Corp.—Ha Tien I, 35%)	Hon Chong, Kien Giang Province	2,300
Do.		Nghi Son Cement Corp. (Taiheiyo Cement Corp. and Mitsubishi Materials Corp. of Japan, 65%; Vietnam National Cement Corp., 35%)	Nghi Son, Thanh Hoa Province	2,150
Do.		Vietnam National Cement Corp. (100% state owned)	Bim Son, But Son, Da Nang, Ha Tien I, Ha Tein II, Hai Phong, Hai Van, Hoang Mai, Hoang Thach, and Tam Diep	12,000
Chromite		Thai Nguyen Nonferrous Metal Co. (wholly owned subsidiary of state-owned Vietnam National Minerals Corp.)	Nui Nua, Thanh Hoa Province	80
Coal, anthracite		Vietnam National Coal Corp. (100% state owned)	Cam Pha, Cao Son, Coc Sau, Vang Danh, Dong Trieu, Ha Lam, Ha Tu, Hong Gai, Khe Cham, Mao Khe, Mong Duong, Cua Ong, Uong Bi in Quang Ninh Province	19,000
Fertilizer:				
Apatite		Vietnam National Chemical Corp. (100% state owned)	Lao Cai, Lao Cai Province	700
Superphosphate		do.	Lam Thao, Phu Tho Province	800
Gas, natural	million cubic meters per day	VietSovPetro (a joint venture of Vietnam Oil and Gas Corp. and Zarubeznheft, a Russian oil company)	Offshore Bach Ho Oilfield	5
Iron ore, pyrite		Mineral Development Co. No. 3 and Geological & Mineral Mining Enterprise 304 (wholly owned subsidiaries of Vietnam National Minerals Corp.)	Ba Vi District, Ha Tay Province; Duyen Hai Quarter, Lao Cai Province	200
Nitrogen, ammonia		Vietnam National Chemical Corp.	Ha Bac, northern Vietnam	55
Petroleum, crude	thousand 42-gallon barrels per day	VietSovPetro	Offshore Bach Ho and Rong oilfields	330
Salt		Vietnam National Salt Corp.	Nam Dinh, Nghe An, and Hai Tin Provinces	850
Steel, crude		Vietnam Steel Corp.	Cai Lan, Thai Nguyen Province, and Phu My, Ba Ria-Vung Tau Province	450
Tin:				
Concentrate		Cao Bang Nonferrous Metal Co. and Nghe Tinh Nonferrous Metal Co. (wholly owned subsidiaries of state-owned Vietnam National Minerals Corp.)	Pia Oac, Cao Bang Province; Quy Hop, Nghe An Province; and Tam Dao, Tuyen Quang Province	4
Refined		Thai Nguyen Nonferrous Metal Co.	Thai Nguyen, Bac Thai Province	2
Titanium, ilmenite		Bimal Minerals Co. Ltd. (Binh Dinh Minerals Co., 40%; Malaysia Mining Corp. and Syarikat Pendorong Sdn. Bhd., 60%)	Cat Khanh, Qui Nhon, and Binh Dinh Provinces	70
Do		Ha Tinh Minerals and Trading Co.	Cam Hoa, Ky Annh-Cam, Xuyen, Ky Khan, and Ky Ninh, Ha Tinh Province	130
Do.		Mineral Development Co. No. 4 and No. 5 (wholly owned subsidiaries of Vietnam National Minerals Corp.)	Vinh City, Nghe An Province; Tuy Hoa, Dong Xuan in Phu Yen Province; and Quang Ngai, Vinh My in Thua Thien-Hu Province	50
Zinc, concentrate		Thai Nguyen Nonferrous Metal Co. (wholly owned subsidiaries of Vietnam National Minerals Corp.)	Cho Dien, Bac Can Province	45